E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.662

Original Research Article

The Effect of Brief Pre-Anesthetic Jaw and Neck Exercises on Intubation Conditions During General Anesthesia: A Prospective Interventional Study

Dr. Selvalakshmi S.[1], Dr. Vishwas G.K.[2], Dr. Kiran B.R.[3], Dr. Uday Chandra H.J.[4]

[1]Third Year Postgraduate, Department of Anaesthesiology, S.S. Institute of Medical Sciences and Research Centre, Davangere, Karnataka, India.
[2]Professor, Department of Anaesthesiology, S.S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
[3]Professor, Department of Anaesthesiology, S.S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.
[4]Second Year Postgraduate, Department of Anaesthesiology, S.S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.

Corresponding Author: Dr. Uday Chandra H.J., Second Year Postgraduate, Department of Anaesthesiology, S.S. Institute of Medical Sciences and Research Centre, Davanagere, Karnataka, India.

Received: 02.04.2026 Revised: 07.05.2026 Accepted: 18.06.2026 Published: 22.06.2026

ABSTRACT

Background: Airway management remains a critical component of anesthetic practice. Restricted mouth opening and reduced neck mobility are established risk factors for difficult laryngoscopy and tracheal intubation. This study evaluated whether a brief pre-anesthetic jaw and neck exercise regimen could improve airway parameters and intubation conditions.

Methods: A prospective interventional study was conducted among 100 ASA I–II patients aged 20–70 years undergoing elective surgery under general anesthesia. Patients were allocated into exercise and control groups. The exercise group performed a 5-minute jaw and neck exercise program before anesthetic induction. Mouth opening, Mallampati score, sternomental distance, intubation time, Cormack–Lehane grade, Intubation Difficulty Scale (IDS), and soft tissue injury were assessed. Statistical analysis included Student's t-test, paired t-test, Chi-square test, and Fisher's exact test.

Results: Patients performing exercises demonstrated significant improvement in mouth opening and Mallampati grading. Mean mouth opening increased to 51.3 ± 6.4 mm compared with 49.0 ± 7.5 mm in controls. Mallampati Grade I was more frequent in the exercise group. Intubation time was significantly reduced (12.5 vs. 18.8 seconds). Soft tissue injury occurred less frequently in the exercise group. IDS scores showed a favorable trend toward easier intubation.

Conclusion: A brief preoperative jaw and neck exercise regimen improves airway dimensions and facilitates tracheal intubation. The intervention is simple, inexpensive, non-invasive, and may enhance perioperative airway safety.

Keywords: Airway Assessment, Intubation, Jaw Exercises, Neck Mobility.

INTRODUCTION

Optimal intubation conditions are critical for the success of airway management during general anesthesia, directly impacting patient safety and procedural efficiency.[1] Difficult intubation remains a significant challenge, often associated with increased morbidity due to prolonged airway manipulation and potential trauma.[2] Various strategies have been explored to improve intubation conditions, including pharmacological agents and positioning techniques.[3] However, there is growing interest in non-pharmacological interventions that can enhance airway anatomy and function prior to anesthesia induction.

Jaw and neck mobility play a pivotal role in facilitating laryngoscopy and endotracheal intubation.[4] Restricted movement or stiffness in these regions can compromise the alignment of the oral, pharyngeal, and laryngeal axes, thereby complicating intubation.[5] Pre-anesthetic exercises targeting the jaw and neck muscles may improve flexibility, reduce muscle tension, and increase the range of motion, potentially

leading to better visualization of the vocal cords and easier passage of the endotracheal tube.

This prospective interventional study aims to evaluate the effect of brief pre-anesthetic jaw and neck exercises on intubation conditions during general anesthesia. By implementing a standardized exercise protocol immediately before induction, the study seeks to determine whether such an intervention can reduce the incidence of difficult intubation, improve laryngoscopic view grades, and decrease intubation time. The findings could provide a simple, cost-effective adjunct to routine preoperative preparation, enhancing airway management outcomes without additional pharmacological burden.

Given the increasing emphasis on patient safety and optimization of anesthesia protocols, investigating non-invasive methods that improve intubation conditions is both timely and clinically relevant. This study will contribute valuable evidence regarding the utility of targeted musculoskeletal exercises as part of the pre-anesthetic regimen, potentially influencing guidelines for airway management practices.

MATERIALS AND METHODS

This prospective interventional study was conducted over one year and included 100 adult patients aged 20 to 70 years scheduled for elective surgery under general anesthesia. Patients with ASA physical status I–II were enrolled, while those with temporomandibular joint disorders, cervical spine disease, craniofacial abnormalities, or anticipated awake fiberoptic intubation were excluded.

After obtaining written informed consent, eligible participants were enrolled in the study and randomly allocated into two equal groups (n = 50 each): the exercise group and the control group. All patients underwent a standardized pre-anesthetic airway assessment before any intervention. Baseline measurements included maximum mouth opening, measured as the inter-incisor distance (in millimeters) using a calibrated ruler with the patient opening the mouth as widely as possible; Mallampati classification, assessed with the patient in the sitting position, mouth fully open, and tongue protruded without phonation; and sternomental distance, measured as the distance from the upper border of the manubrium sterni to the tip of the mentum with the neck fully extended and the mouth closed.

Participants assigned to the exercise group performed a standardized 5-minute pre-anesthetic jaw and neck exercise protocol under the supervision of an anesthesiologist. The exercise regimen consisted of four components. Initially, gentle bilateral masseter muscle massage was performed using circular motions over the masseter muscles for approximately one minute to reduce muscle stiffness and promote relaxation. This was followed by neck flexion and extension exercises, during which patients slowly flexed the neck forward and extended it backward through the maximum comfortable range of motion for approximately one minute. Subsequently, neck rotation exercises were carried out by rotating the head alternately toward the left and right shoulders in a controlled manner for one minute to improve cervical mobility. Finally, active and passive mandibular stretching exercises were performed for approximately two minutes, during which patients repeatedly opened the mouth to the maximum comfortable extent, followed by gentle passive stretching assisted by the investigator to further increase temporomandibular joint mobility. All exercises were performed within the patient's pain-free range of motion, and patients were continuously observed to ensure correct technique and safety.

Participants in the control group did not receive any pre-anesthetic exercise intervention and remained seated quietly during the corresponding five-minute period before induction of anesthesia.

Following completion of the intervention, all patients underwent standard monitoring in the operating room, including electrocardiography, non-invasive blood pressure measurement, pulse oximetry, and capnography. General anesthesia was induced according to the institutional protocol using standardized anesthetic agents and muscle relaxants. Following adequate neuromuscular blockade, direct laryngoscopy was performed by an experienced anesthesiologist using an appropriately sized Macintosh laryngoscope blade, and endotracheal intubation was carried out using standard techniques.

During intubation, several outcome measures were recorded. Intubation time was measured in seconds from insertion of the laryngoscope blade between the patient's teeth until successful placement of the endotracheal tube, confirmed by capnography. The Cormack–Lehane grading was documented to

assess the laryngoscopic view obtained during intubation. The Intubation Difficulty Scale (IDS) score was calculated for each patient based on the number of intubation attempts, operators involved, alternative techniques required, lifting force applied, external laryngeal manipulation, vocal cord position, and overall ease of intubation. Following completion of intubation, the oral cavity and pharynx were inspected for evidence of oropharyngeal soft tissue injury, including trauma to the lips, tongue, gums, or pharyngeal mucosa. All airway assessments and intubation-related observations were recorded in a predesigned data collection proforma for subsequent statistical analysis.

Statistical Analysis

Data analysis was conducted using SPSS software; continuous variables were presented as mean ± standard deviation and compared using Student's t-test, with paired t-tests applied to pre- and post-intervention comparisons. Categorical variables were analyzed using Chi-square and Fisher's exact tests. Statistical significance was set at $p < 0.05$, and study power was maintained at 80% with an alpha of 0.05.

RESULTS

The exercise group demonstrated significantly better airway parameters than controls. Mouth opening improved significantly following the exercise protocol. Sternomental distance also increased, indicating enhanced neck mobility. A greater proportion of patients achieved Mallampati Grade I after intervention.

Intubation characteristics were improved in the exercise group. Mean intubation time was reduced from 18.8 seconds in controls to 12.5 seconds in exercise group. Requirements for increased lifting force and external laryngeal manipulation were lower. Soft tissue injury incidence decreased significantly.

Baseline airway parameters and airway mobility were compared between the control and exercise groups following the intervention. Patients who performed the brief jaw and neck exercise demonstrated better mouth opening, sternomental distance, and Mallampati scores, indicating improved airway anatomy prior to intubation. **(Table 1)**

Parameter	Control Group	Exercise Group
Mouth opening (mm), Mean ± SD	49.0 ± 7.5	51.3 ± 6.4
Sternomental distance (SMD) (mm), Mean ± SD	37.5 ± 2.4	43.9 ± 2.8
Patients with Mallampati Grade I (%)	13 (26.0)	21 (42.0)

Table 1. Comparison of airway assessment parameters between control and exercise groups

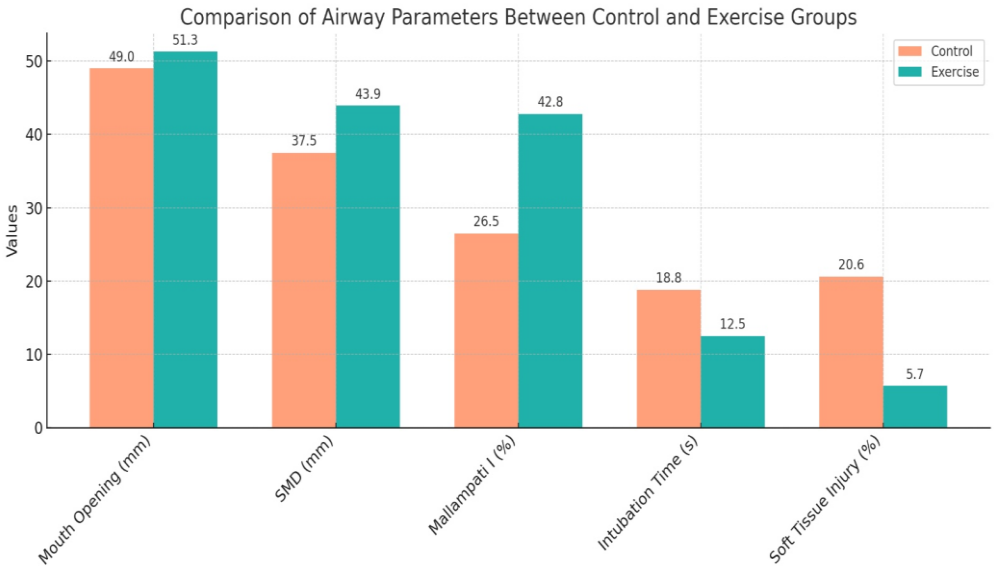

Figure 1: Comparison of airway parameters between control and exercise groups

The intubation outcomes were evaluated between the study groups to determine the effect of the exercise protocol on airway management. The exercise group showed a significantly shorter intubation time and a markedly lower incidence of

oropharyngeal soft tissue injury compared to the control group, suggesting that pre-anesthetic jaw and neck exercises contributed to easier and safer tracheal intubation. (Table 2)

Outcome	Control Group	Exercise Group	P value*
Intubation time (seconds), Mean ± SD	18.8 ± 4.6	12.5 ± 3.8	<0.001
Soft tissue injury, n (%)	21 (42.0%)	6 (12.0%)	<0.001

Table 2. Comparison of Intubation Outcomes Between Control and Exercise Groups

Laryngoscopic findings and intubation difficulty were compared between the control and exercise groups. Although the distribution of Cormack–Lehane grades was comparable between the groups, the exercise group demonstrated significantly lower Intubation Difficulty Scale (IDS) scores, indicating that the exercise regimen improved the overall ease of tracheal intubation without significantly altering laryngoscopic grade. (Table 3)

Variable	Control Group n (%)	Exercise Group n (%)	P value*
Cormack–Lehane Grade I	31 (62.0%)	32 (64.0%)	0.840
Cormack–Lehane Grade II	19 (38.0%)	18 (36.0%)	
Intubation Difficulty Scale (IDS), Mean ± SD	1.2 ± 0.8	0.6 ± 0.5	0.003*

Table 3. Comparison of Laryngoscopic Findings Between Control and Exercise Groups

The pie chart illustrates the distribution of patients with oropharyngeal soft tissue injury following tracheal intubation. The incidence of soft tissue injury was substantially lower in the exercise group than in the control group, demonstrating that the brief pre-anesthetic jaw and neck exercise protocol reduced airway-related trauma during laryngoscopy and intubation. (Figure 2)

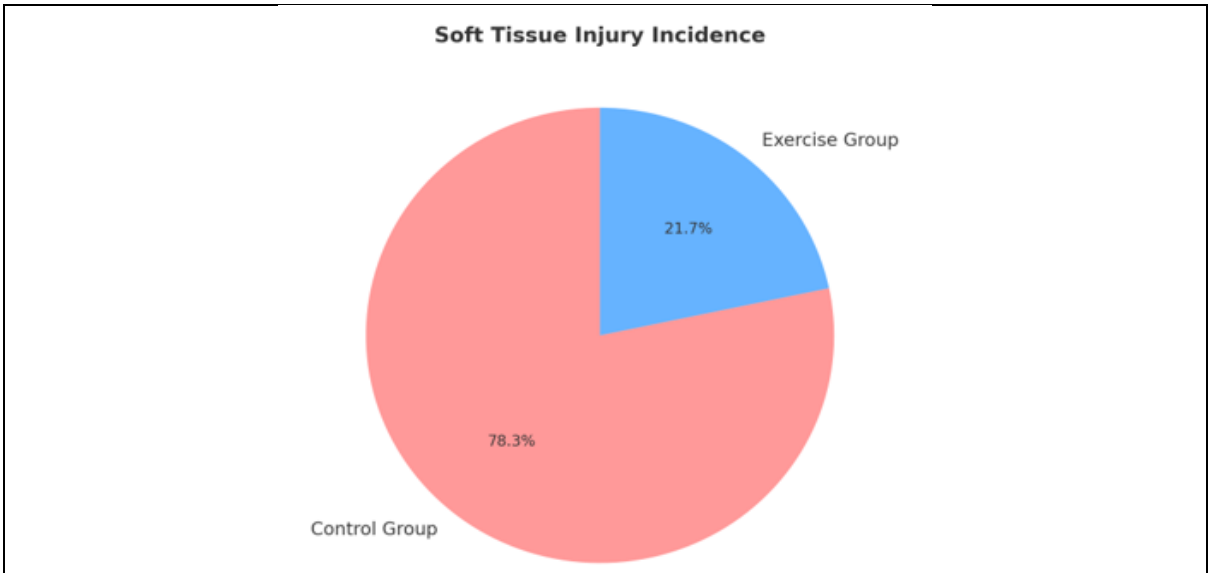

Figure 2: Pie chart representing the incidence of soft tissue injury

The stacked bar chart presents the Chi-square analysis of selected categorical outcomes between the control and exercise groups, including Mallampati Grade I, soft tissue injury, and Cormack–Lehane Grade I. The exercise group showed a higher proportion of favorable Mallampati Grade I airways and a lower incidence of soft tissue injury, while the distribution of Cormack–Lehane Grade I was comparable between the groups, supporting the beneficial effect of the intervention on airway assessment and intubation outcomes. (Figure 3)

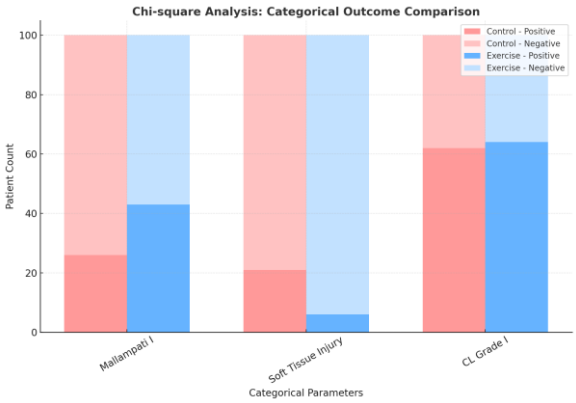

Figure 3: Chi-square analysis of the outcomes of the study

DISCUSSION

This study demonstrated that a brief pre-anesthetic jaw and neck exercise regimen significantly improved airway parameters and intubation conditions in patients undergoing general anesthesia. Specifically, the exercise group showed increased mouth opening, improved Mallampati grades, enhanced sternomental distance, reduced intubation time, lower Intubation Difficulty Scale (IDS) scores, and decreased incidence of oropharyngeal soft tissue injury compared with controls. These findings align with and expand upon existing literature evaluating non-pharmacologic interventions aimed at optimizing airway management and reducing intubation-related morbidity.

Improved mouth opening observed after exercise may be attributed to enhanced temporomandibular joint mobility and reduced masseter muscle stiffness. Similarly, increased sternomental distance reflects improved cervical mobility. These physiological changes contribute to easier alignment of airway axes during laryngoscopy.

The reduction in intubation time observed in the exercise group is clinically important. Faster intubation minimizes apnea duration and may reduce the risk of hypoxemia.[6] Reduced requirement for increased lifting force and external laryngeal manipulation further suggests improved airway accessibility. A notable finding was the significant reduction in oropharyngeal soft tissue injury. Excessive force during laryngoscopy can result in lip, tongue, gum, and pharyngeal trauma. By improving airway access, exercises appear to reduce the need for aggressive manipulation.

The intervention is helpful because it requires minimal resources and takes only five minutes to administer. The benefits may be particularly relevant in patients with borderline airway parameters. Further large-scale multicenter studies are needed to validate these findings and determine applicability in difficult airway populations.

The results from this study are consistent with those reported by Lee et al., who conducted a randomized controlled trial assessing a similar brief pre-anesthetic exercise protocol involving masseter massage and jaw and neck stretching.[7] Lee et al. observed significant improvements in mouth opening and Mallampati scores post-exercise, with a higher proportion of patients achieving Mallampati Grade I. While sternomental distance (SMD) did not differ significantly between groups in their study, within-group analysis showed improvement after exercise, which parallels the significant SMD increase reported here.[7] Both studies noted a reduction in intubation time and soft tissue injuries in the exercise groups, underscoring the clinical relevance of such interventions to facilitate easier and safer intubation. However, some divergence exists regarding the Intubation Difficulty Scale outcomes. Lee et al. reported no significant difference in IDS scores between groups, whereas the current study found significantly lower IDS scores in the exercise group, suggesting improved ease of intubation.[7] This discrepancy may relate to differences in sample size, patient populations, or specific exercise protocols. Notably, the current study also reported a significant reduction in the need for increased lifting force and external laryngeal manipulation, which may contribute to the lower IDS scores observed.

Regarding alternative airway management maneuvers, the jaw thrust maneuver has been investigated for its role in improving intubation conditions and reducing postoperative sore throat.[8] Saxena et al. and Huh et al. conducted prospective randomized studies demonstrating that the jaw thrust

maneuver during intubation reduces the incidence of postoperative sore throat and hoarseness and shortens laryngoscopy time.[9,10] These findings complement the current study by highlighting another simple, non-invasive technique that enhances airway patency and reduces airway trauma during intubation. Huh et al. further demonstrated that jaw thrust reduced the severity of sore throat and hoarseness without increasing complications such as jaw discomfort, supporting the safety and efficacy of this maneuver.[9]

Conversely, Park et al. revealed that the jaw thrust maneuver induces significant sympathetic responses, including increases in arterial blood pressure and heart rate, independent of the force magnitude applied.[11] This sympathetic activation may have clinical implications, especially in patients with cardiovascular comorbidities. While the current study did not specifically assess hemodynamic responses during the exercise regimen, the brief duration and gentle nature of the jaw and neck exercises suggest a lower likelihood of provoking such responses compared to the sustained jaw thrust maneuver described by Park et al.[11] Nonetheless, clinicians should remain vigilant when applying airway maneuvers that may stimulate sympathetic activity.

Taken together, the evidence supports the incorporation of targeted musculoskeletal exercises and airway maneuvers such as jaw thrust into pre-anesthetic preparation and intubation practice. The brief pre-anesthetic exercise protocol is advantageous due to its simplicity, low cost, and non-invasive nature, making it feasible for routine clinical use.[12] It improves airway anatomy and function, facilitating easier intubation, reducing intubation time, and minimizing tissue trauma. The jaw thrust maneuver similarly improves glottic exposure and reduces postoperative airway morbidity but may be associated with transient sympathetic stimulation, warranting cautious application in susceptible patients.

Limitations across studies include variability in patient populations, exclusion of difficult airway cases, and differences in assessment methods for airway parameters and intubation difficulty. The current study's findings are strengthened by the use of objective measurements and standardized protocols but would benefit from larger, multicenter trials to confirm generalizability and assess long-term outcomes. Future research should also explore the combined effects of pre-anesthetic exercises and airway maneuvers, their impact on difficult airway populations, and hemodynamic safety profiles.

CONCLUSION

The current study corroborates and extends prior research demonstrating that brief pre-anesthetic jaw and neck exercises enhance airway parameters and intubation conditions. Alongside maneuvers like jaw thrust, these interventions offer effective, low-resource strategies to improve perioperative airway management and reduce complications such as soft tissue injury and postoperative sore throat. Integration of such techniques into routine anesthetic practice promises to enhance patient safety and comfort.

REFERENCES

1. Jung H. A comprehensive review of difficult airway management strategies for patient safety. Anesth Pain Med (Seoul) 2023;18(4):331-9.
2. Liaqat T, Amjad MA, Cherian SV. Difficult airway management in the intensive care unit: a narrative review of algorithms and strategies. J Clin Med 2025;14(14):4930.
3. Natt BS, Malo J, Hypes CD, et al. Strategies to improve first attempt success at intubation in critically ill patients. Br J Anaesth 2016;117:i60-8.
4. Kumar MS, Zachariah K V, Joel J C. Airway assessment: Predictors for difficult intubation - A prospective observational study. Indian J Clin Anaesth 2023;10(1):11-20.
5. Nanjangud P. Difficult airway in intensive care unit. Indian Journal of Respiratory Care 2022;4(2):599-610.
6. White LD, Vlok RA, Thang CY, et al. Oxygenation during the apnoeic phase preceding intubation in adults in prehospital, emergency department, intensive care and operating theatre environments. Cochrane Database of Systematic Reviews 2023;8(8):CD013558.
7. Lee SY, Bae S Il, Do SH, et al. The effect of brief pre-anesthetic exercise therapy of jaw and neck joints on mouth opening, neck extension, and intubation conditions during induction of general anesthesia: a randomized controlled trial. BMC Anesthesiol 2020;20(1):28.

8. Ramakkannu K, Theagrajan A, Prabhu M, et al. Comparison of three airway maneuvers of jaw thrust, two-handed e-c technique with head in neutral position, and two-handed e-c technique with head fully extended: a prospective, randomized, double-blind crossover study. Cureus 2024;16(2):e53791.
9. Huh H, Go DY, Cho JE, et al. Influence of two-handed jaw thrust during tracheal intubation on postoperative sore throat: a prospective randomised study. J Int Med Res 2021;49(2):0300060520961237.
10. Saxena D, Rathore A, Jain P, et al. Evaluating the role of the jaw thrust maneuver during tracheal intubation in reducing the incidence of postoperative sore throat: a prospective randomized study. Ochsner Journal 2025;25(1):17-23.
11. Park SJ, Kim BS, Jee DL. Jaw-thrust induces sympathetic responses during induction of general anesthesia. Korean J Anesthesiol 2013;65(2):127.
12. Minnella EM, Ferreira V, Awasthi R, et al. Effect of two different pre-operative exercise training regimens before colorectal surgery on functional capacity. Eur J Anaesthesiol 2020;37(11):969-78.